Summary of Results from
Test Drilling, Installation of Monitoring Wells, and Measurement of Water Levels
by the Department of Environment and Natural Resources
Related to the Proposed Hyperion Energy Center in Union County, South Dakota

Test drilling and installation of monitoring wells were performed by the Geological Survey Program, Department of Environment and Natural Resources, from July 2, 2008, through September 2, 2008. The purpose of the work was to refine the existing understanding of subsurface geologic and hydrologic conditions in the area of the proposed Hyperion Energy Center and to establish some permanent ground-water monitoring sites. Fifteen holes were drilled, five of which were completed as monitoring wells. The locations of test holes and wells are shown on the illustration titled *Test drilling and well installation in 2008 in the area of the proposed Hyperion Energy Center*.

The understanding of subsurface conditions prior to the new drilling was based on (1) the two publications listed below, (2) an online database of test-hole and well information (http://www.sddenr.net/lithdb), and (3) additional well information in the files of the Water Rights Program, Department of Environment and Natural Resources. The two publications are as follows.

McCormick, K.A., and Hammond, R.H., 2004, *Geology of Lincoln and Union Counties, South Dakota*: South Dakota Geological Survey Bulletin 39
For free download of this report, navigate to the following web address and scroll down to B-39.
http://www.sddenr.net/publist/search_results_publist.cfm?limit_to_download=Yes&sql_option=2

Niehus, Colin A., 1994, *Water resources of Lincoln and Union Counties, South Dakota*: U.S. Geological Survey Water-Resources Investigations Report 93-4195.
This publication can be viewed online at http://pubs.er.usgs.gov/usgspubs/wri/wri934195

The surface footprint of land rezoned for the proposed Hyperion Energy Center (taken from http://www.hyperionec.com/files/FinalPDBoundary.pdf) sits largely on ground moraine which is a type of glacially derived sediment named till. The relationship of the footprint of the rezoned land to the surface geology is shown on the illustration titled *Map of surface geology in the area of the proposed Hyperion Energy Center*. An older bedrock surface exists at various depths below the glacial sediments. The elevation and types of bedrock that comprise this surface are shown on the illustration titled *Map of bedrock geology in the area of the proposed Hyperion Energy Center*. This bedrock surface is coincident with land surface at a few locations in the immediate area of the proposed Hyperion Energy Center (see labels Kc and Kg along Brule Creek on the map showing surface geology). A more complete description of the surface and subsurface geology is available in McCormick and Hammond (2004).

A buried sand and gravel aquifer exists in the vicinity of the proposed Hyperion Energy Center. This aquifer is named the Lower-Vermillion-Missouri aquifer where it occurs north of the Missouri River valley and the Missouri aquifer where it occurs under the Missouri River valley. The illustration titled *Cross section showing subsurface geology below the proposed Hyperion Energy Center* shows the relationships of the various geologic units, including the sand and gravel aquifer (labeled Qpio on the cross section), under part of the proposed energy center.

Based on a pre-existing network of observation wells maintained and measured by the Water Rights Program, Department of Environment and Natural Resources, appropriate locations for new, permanent water-quality monitoring wells were selected in the vicinity of the proposed Hyperion Energy Center. The locations of the newly installed water-quality monitoring wells and the other wells used to establish the flow direction of ground water in the aquifer are shown in the illustration titled *Ground-water flow direction in the buried sand and gravel aquifer in the area of the proposed Hyperion Energy Center*.

Three monitoring wells were installed in the buried aquifer and two monitoring wells were installed in surface sediments near Brule Creek. Of the three wells installed in the buried aquifer, one well (R2-2008-23) is in an up-gradient direction and two wells (R2-2008-22 and R2-2008-24) are in a down-gradient direction from the proposed Hyperion Energy Center. Similarly, one of the two wells installed in surface sediments near Brule Creek is in an upstream direction (R20-2008-03) and the other is in a downstream direction (R20-2008-04) from the proposed Hyperion Energy Center.

In general, the test drilling confirmed the descriptions and illustrations of subsurface geology presented in McCormick and Hammond (2004) and Niehus (1994). Two noteworthy differences are as follows.

1. The elevation and type of the first bedrock unit encountered in the newly drilled test holes were not always consistent with the published map of bedrock geology in McCormick and Hammond (2004). The new test-hole data were used to modify the published map of bedrock geology.

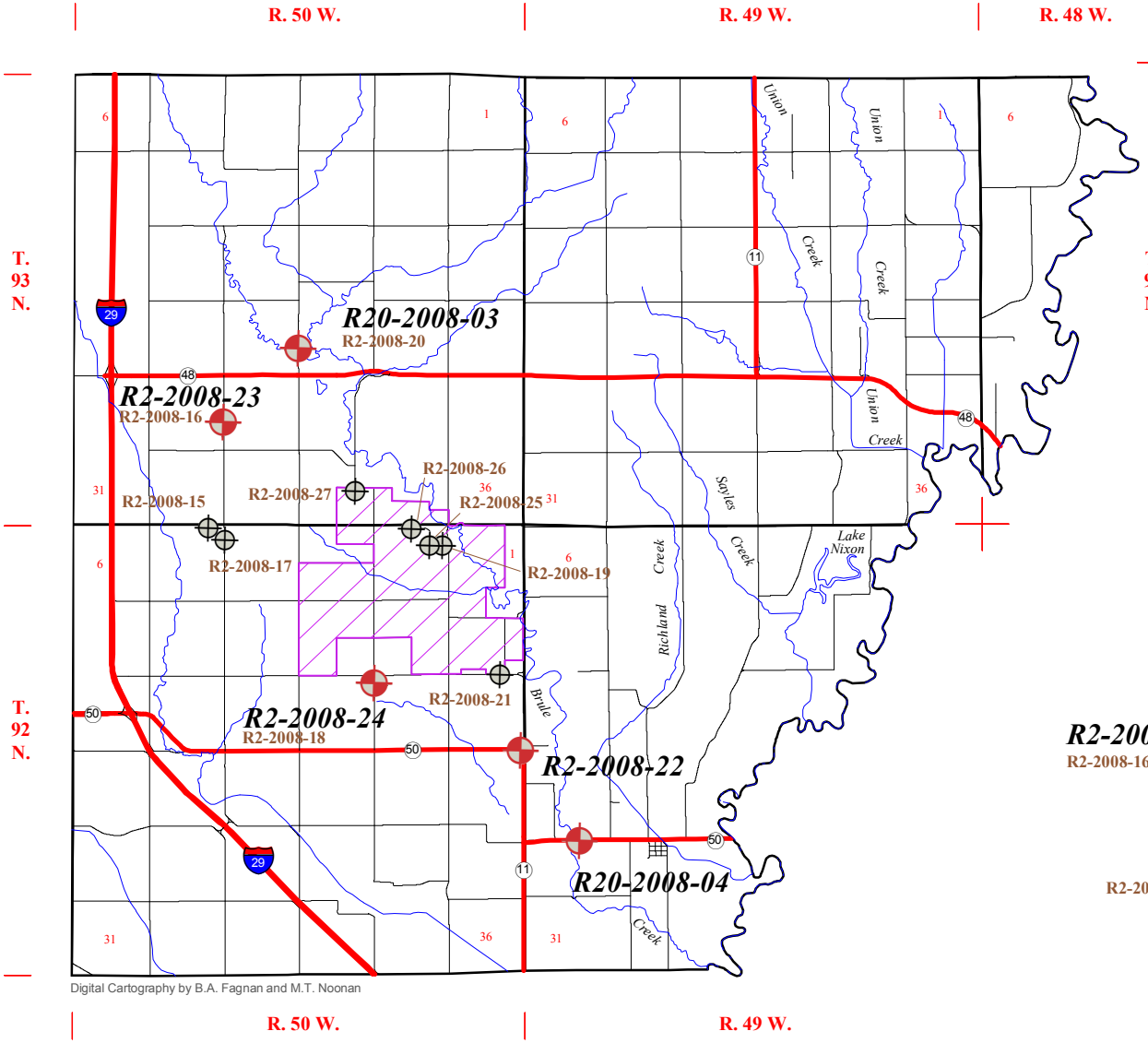
2. The buried sand and gravel aquifer does not exist as far to the east as the published reports indicated in the immediate vicinity of the proposed Hyperion Energy Center. The eastern boundary of the aquifer was modified using (a) new and existing test-hole data and (b) an evaluation of the possible eastern extent of the aquifer as compared with bedrock topography.

The five monitoring wells installed in 2008 will become part of a much larger statewide network of water-quality monitoring wells named the Statewide Ground Water Quality Monitoring Network. A report about the larger monitoring-well network can be downloaded for free. Navigate to the following web address and scroll down to UR-89.

http://www.sddenr.net/publist/search_results_publist.cfm?limit_to_download=Yes&sql_option=17

The five newly installed monitoring wells will be used to document the quality of ground water prior to any construction activity that may be forthcoming related to the proposed Hyperion Energy Center. The wells will also be used to examine the quality of the ground water over time similar to the other wells in the Statewide Ground Water Quality Monitoring Network.

Test drilling and well installation in 2008 in the area of the proposed Hyperion Energy Center



1 0.5 0 1 2 3 Miles

1 0.5 0 1 2 3 Kilometers

Area rezoned for the proposed Hyperion Energy Center

R2-2008-23
R2-2008-16

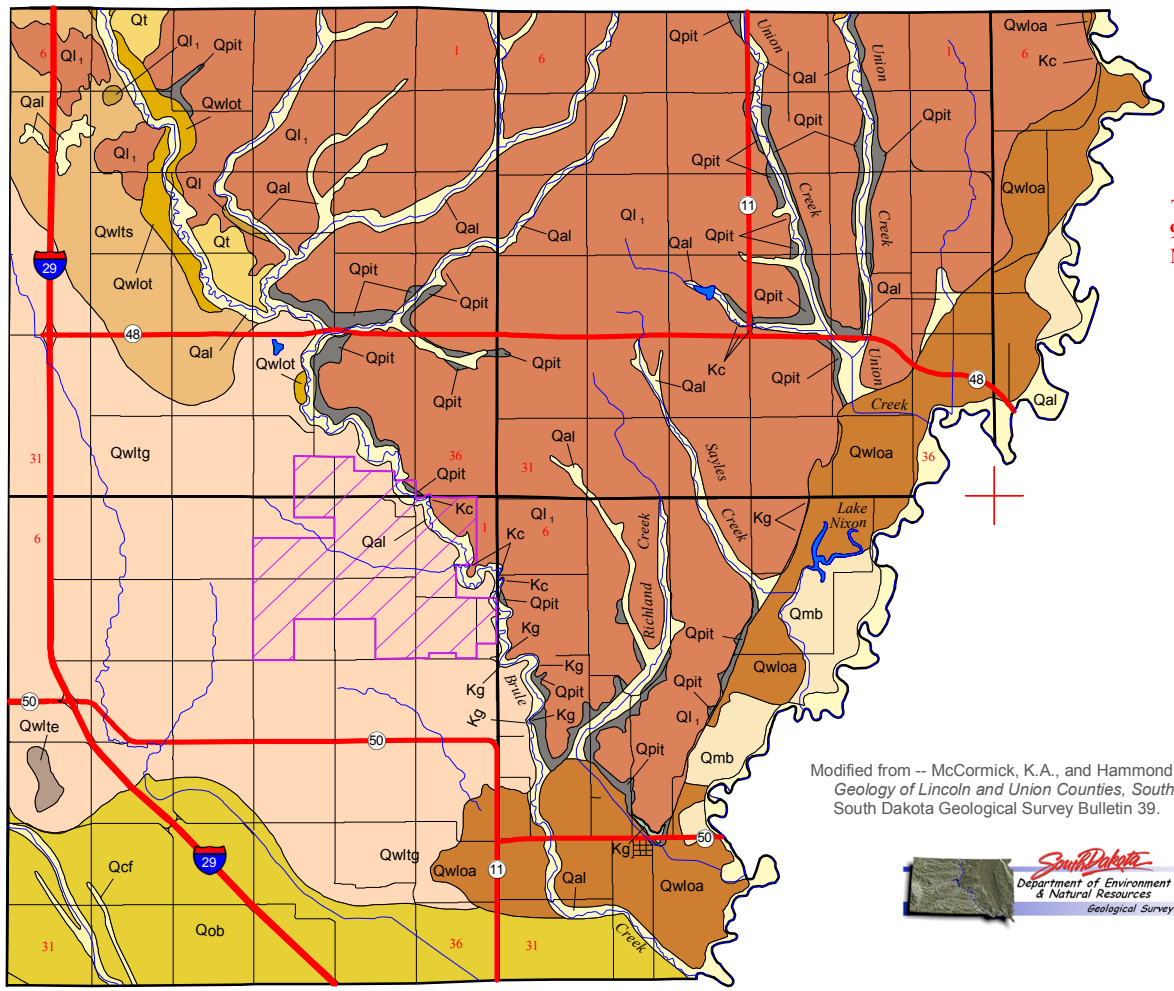
Monitoring Well - A label in the style of **R2-2008-23** is the well/test-hole identifier. An additional label in the style of R2-2008-16 is the identifier of a test hole at the same location that was not completed as a monitoring well.

R2-2008-21

Test Hole - The label is the test-hole identifier.

South Dakota Department of Environment & Natural Resources Geological Survey

Map of surface geology in the area of the proposed Hyperion Energy Center



Modified from -- McCormick, K.A., and Hammond, R.H., 2004, *Geology of Lincoln and Union Counties, South Dakota*: South Dakota Geological Survey Bulletin 39.

Digital Cartography by B.A. Fagnan and M.T. Noonan

1 0.5 0 1 2 3 Miles

1 0.5 0 1 2 3 Kilometers

Area rezoned for the proposed Hyperion Energy Center

Qwlot — **Outwash Terrace** - Sand and gravel of glaciofluvial origin; confined to a valley; sloping to a relatively flat surface.

Qwltg — **Till, Ground Moraine** - Heterogeneous mixture of boulders, pebbles, sand, silt, and clay; flat to gently undulating topography.

Qwlts — **Till, Stagnation Moraine** - Heterogeneous mixture of boulders, pebbles, sand, silt, and clay; undulating to hummocky topography characterized by poorly-developed drainages with numerous lakes and sloughs.

Qwlte — **Till, End Moraine** - Heterogeneous mixture of boulders, pebbles, sand, silt, and clay; relatively elevated topography.

Qo — **Sand and Gravel** - Sand and gravel with minor silt and clay of unknown age.

Qpit — **Till** - Hetergeneous mixture of boulders, pebbles, sand, silt, and clay; typically occurs at higher elevation than late Wisconsin till; topography is characterized by well-developed drainages.

Kc — **Carlile Shale** - A greasy, dark-gray, concretionary shale; the lower part can be calcareous with numerous thin, silty beds; the upper part is non calcareous and organic-rich with occasional thin sandstone and siltstone lenses.

Kg — **Greenhorn Limestone** - Interbedded gray, silty, calcareous shale, calcarenite, and hard skeletal limestone.

Qal — **Alluvium** - Stream deposits of silt and clay with minor amounts of sand and gravel.

Qob — **Overbank** - Flood deposits of mainly clay and silt with minor sand.

Qmb — **Meander Bar** - Abandoned river channels and bars consisting of mainly clay and silt in the channels and sand and gravel in the bars.

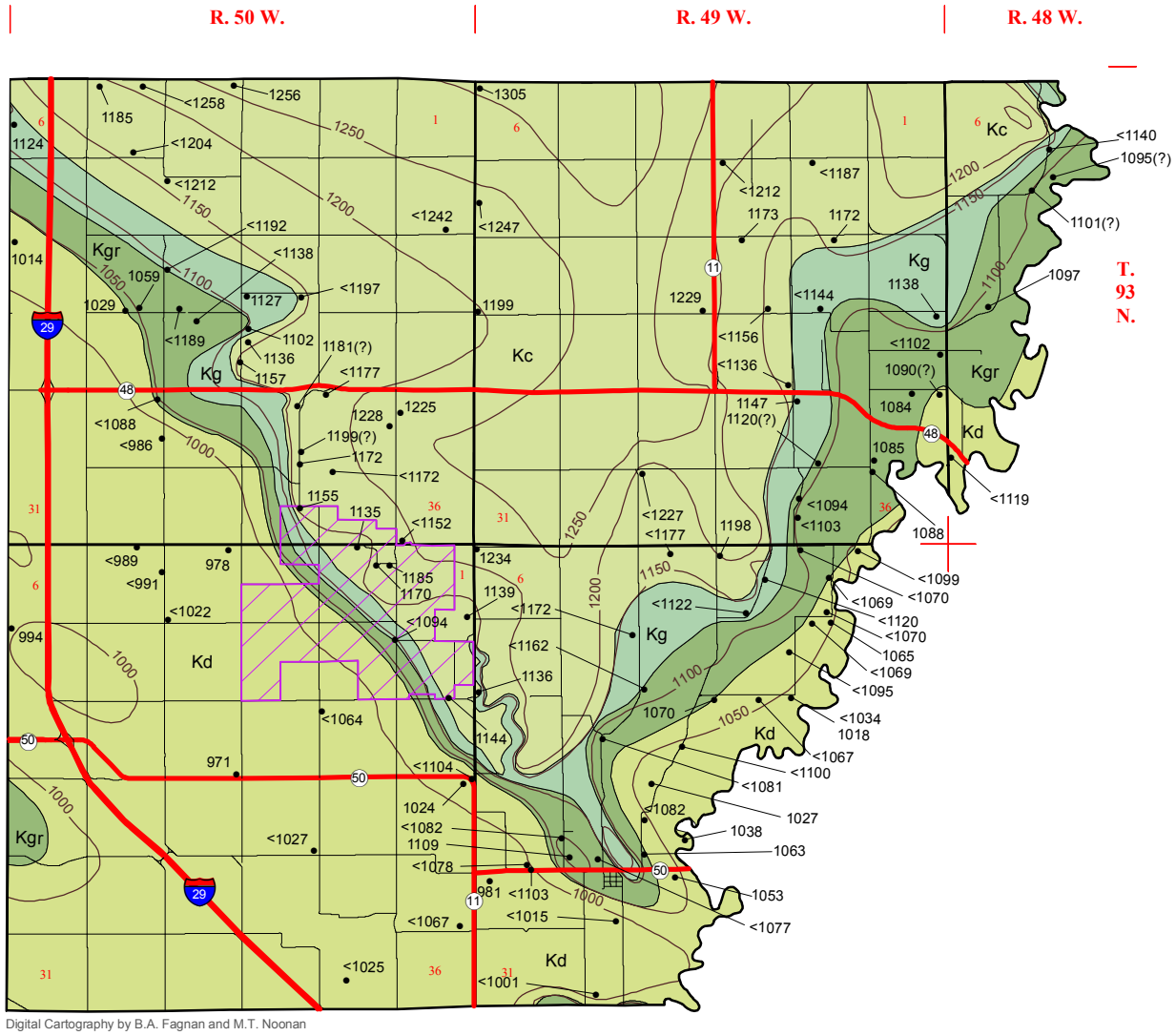
Qcf — **Channel Fill** - Clay and minor silt and sand filling an abandoned river channel.

Ql — **Loess** - Eolian deposits of mainly silt-sized grains; forms relatively steep slopes; calcareous; gray, weathering to yellow or red.

Ql1 — **Loess** - Eolian deposits of mainly silt-sized grains; forms relatively steep slopes; calcareous; gray, weathering to yellow or red; overlying pre-Illinoian till.

Qt — **Terrace** - Mainly clay forming a flat to gently sloping surface adjacent to streams; likely an erosional surface formed on till.

Qwloa — **Outwash and Alluvium** - Sand and gravel of glaciofluvial origin with minor alluvial overburden; confined to a valley.



Digital Cartography by B.A. Fagnan and M.T. Noonan

Map of bedrock geology in the area of the proposed Hyperion Energy Center

1 0.5 0 1 2 3 Miles

1 0.5 0 1 2 3 Kilometers

Area rezoned for the proposed Hyperion Energy Center

Kc — **Carlile Shale** - A greasy, dark-gray, concretionary shale; the lower part can be calcareous with numerous thin, silty beds; the upper part is non calcareous and organic-rich with occasional thin sandstone and siltstone lenses.

Kg — **Greenhorn Limestone** - Interbedded gray, silty, calcareous shale, calcarenite, and hard skeletal limestone.

Kgr — **Granerous Shale** - Gray-brown, waxy to gritty, slightly calcareous shale.

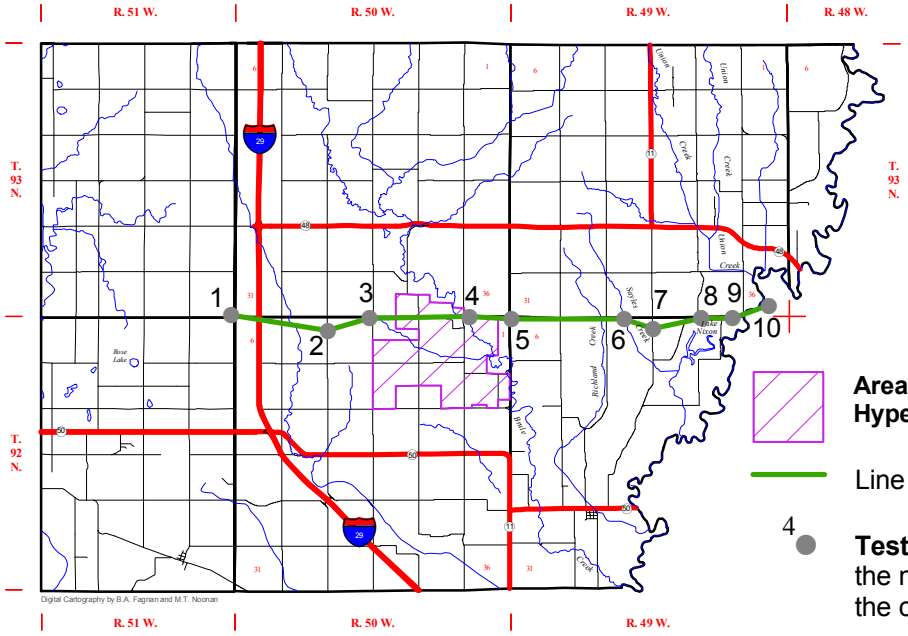
Kd — **Dakota Formation** - Interbedded shale, siltstone, and sandstone with minor coal seams.

Contour line - connecting points of equal elevation on the bedrock surface. Contour interval = 50 feet.

South Dakota Department of Environment & Natural Resources Geological Survey

Modified from -- McCormick, K.A., and Hammond, R.H., 2004, *Geology of Lincoln and Union Counties, South Dakota*: South Dakota Geological Survey Bulletin 39.

Cross section showing subsurface geology below the proposed Hyperion Energy Center



South Dakota Department of Environment & Natural Resources Geological Survey

Area rezoned for the proposed Hyperion Energy Center

Line of cross section

4 **Test hole or well** - The label is the map location number used in the cross section

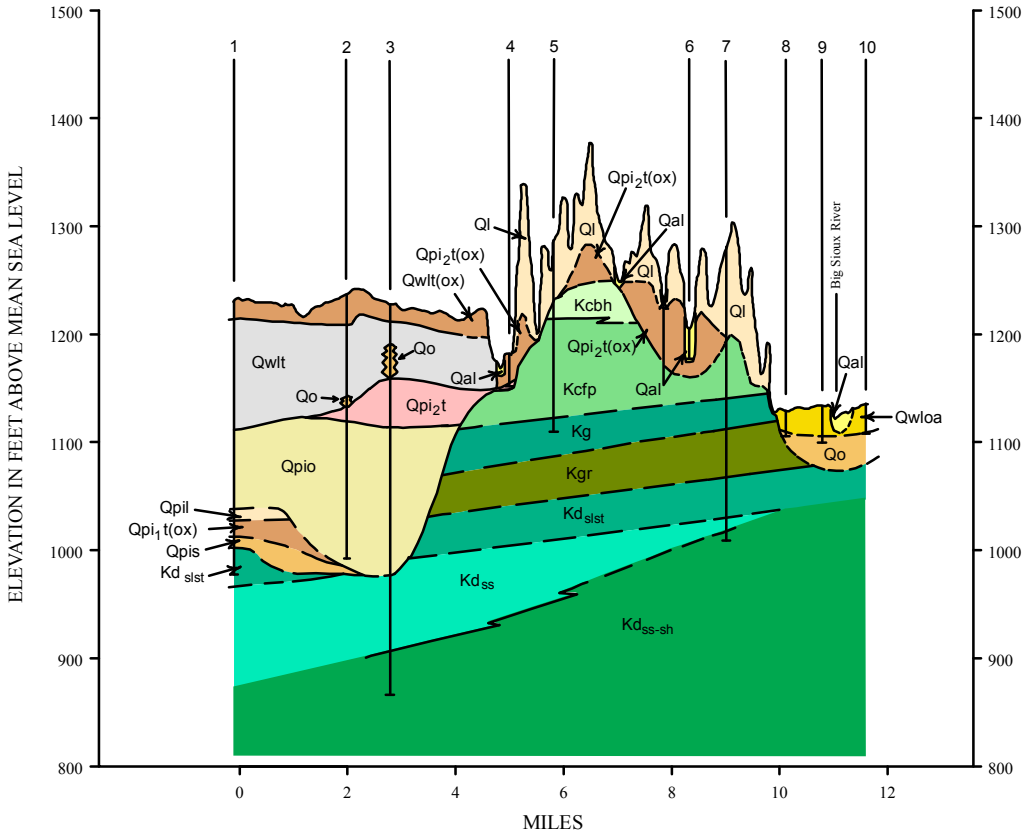
Map location number	Test hole number or SDGS well name
1	R2-85-128
2	R2-2008-17
3	R1-84-103
4	A2-86-176
5	R2-85-134
6	A1-86-141
7	R2-85-133
8	R20-85-104
9	A2-86-164
10	R20-85-57

Clay Co., SD / Union Co., SD

Vertical Exaggeration = 105.6X

West ← → East

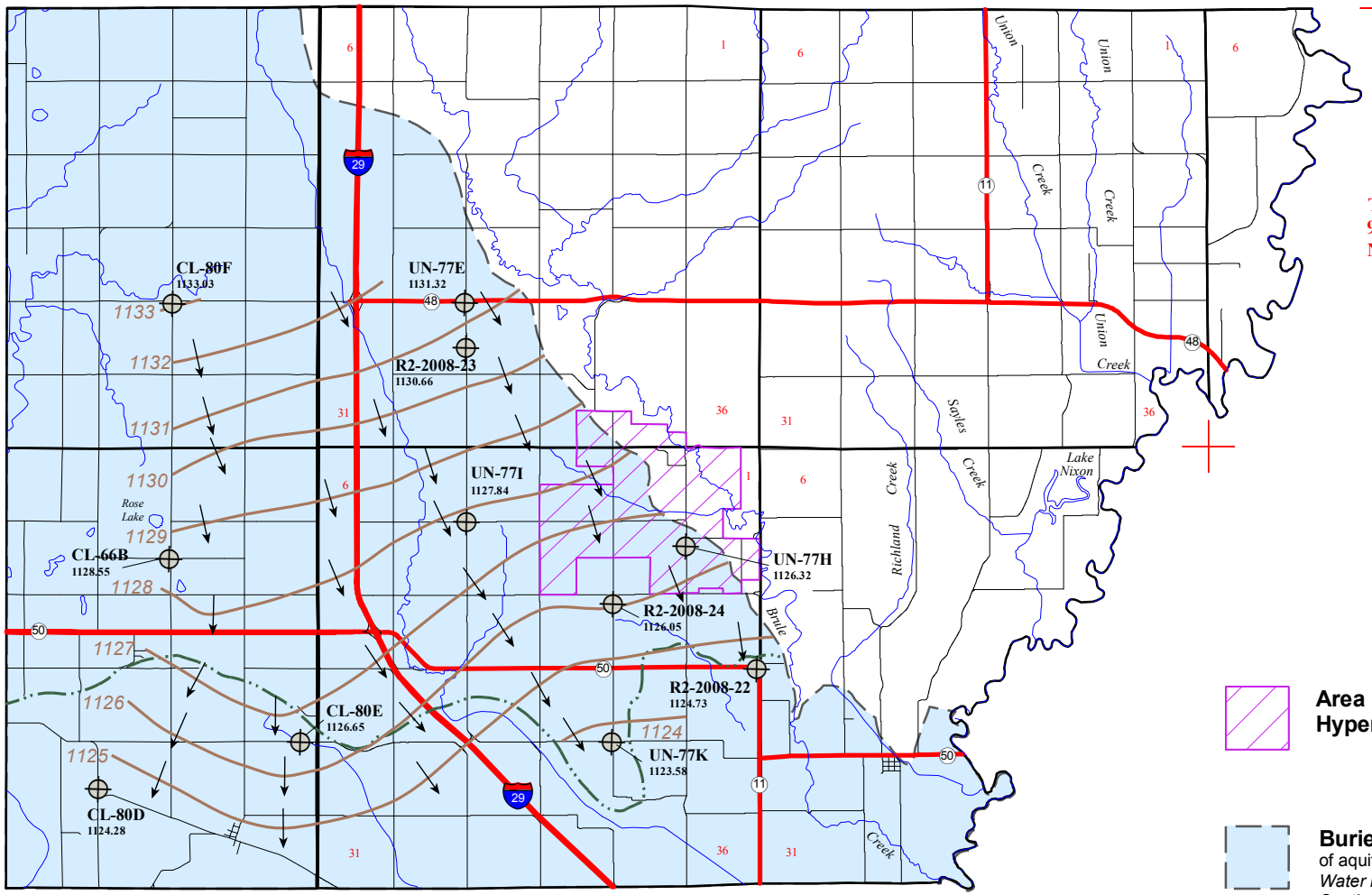
Union Co., SD / Plymouth Co., IA



Legend for geologic cross section

Qal	Holocene alluvium
Ql	late Wisconsin to Holocene loess, undifferentiated
Qwloa	late Wisconsin outwash and/or Holocene alluvium, undifferentiated
Qwlt(ox)	late Wisconsin till (oxidized)
Qwlt	late Wisconsin till
Qo	late Wisconsin or pre-Illinoian outwash, undifferentiated
Qpio	pre-Illinoian outwash, undifferentiated
Qpil	pre-Illinoian loess, undifferentiated
$Qpi_2t(ox)$	pre-Illinoian 2 till (oxidized)
Qpi_2t	pre-Illinoian 2 till
$Qpi_1t(ox)$	pre-Illinoian 1 till (oxidized)
Qpis	pre-Illinoian nonglacial (?) quartz sand and gravel
Kcbh	Carlile Shale, Blue Hill Shale Member
Kcfp	Carlile Shale, Fairport Shale Member
Kg	Greenhorn Limestone
Kgr	Graneros Shale
Kd_{ss}	Dakota Formation, sandstone
Kd_{slst}	Dakota Formation, siltstone
Kd_{ss-sh}	Dakota Formation, interbedded sandstone and shale

Cross section modified from:
McCormick, K.A., and Hammond, R.H., 2004, *Geology of Lincoln and Union Counties, South Dakota*: South Dakota Geological Survey Bulletin 39.



Digital Cartography by B.A. Fagnan and M.T. Noonan

South Dakota Department of Environment & Natural Resources Geological Survey

Ground-water flow direction in the buried sand and gravel aquifer in the area of the proposed Hyperion Energy Center

1 0.5 0 1 2 3 Miles

1 0.5 0 1 2 3 Kilometers

Area rezoned for the proposed Hyperion Energy Center

Buried sand and gravel aquifer - Extent of aquifer modified from -- Niehus, Colin A., 1994, *Water resources of Lincoln and Union Counties, South Dakota*: U.S. Geological Survey Water-Resources Investigations Report 93-4195.

CL-80F
1131.90

Well - A label in the style of CL-80F is the well identifier. An additional label in the style of 1131.90 is the elevation of ground-water in feet above mean sea level.

1125

Contour line - connecting points of equal elevation, in feet above mean sea level, on the ground-water/potentiometric surface. Arrow indicates general direction of ground-water flow. Water levels measured on September 4, 2008.

Approximate location of the northern edge of the Missouri River valley

Records of drilling and well completion for work performed in 2008 by the Geological Survey Program, Department of Environment and Natural Resources, in the area of the proposed Hyperion Energy Center

Location Information

Legal Location:NE NW SW NE SEC. 30, T. 092 N., R. 49 W.
County:UNION
Location:092N-49W-30ACBA
Basin:BIG SIOUX
Latitude:42 45' 42"
Hydrologic Unit Code:10170203
Longitude: 96 40' 23"
Land Owner:
Ground Surface Elevation (ft.):1132.97 I

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:09/03/2008
Geologist's Log:X
Company:SDGS
Driller:D. IVERSON
Drilling Method:AUGER
Driller's Log:
Test Hole Number:R20-2008-04
Total Drill Hole Depth (ft.):30.0
Samples:

Well Information

SDGS Well Name: R20-2008-04
Aquifer:ALLUVIUM
Water Rights Well:
Management Unit:
Other Well Name:
Casing Top Elevation:1134.97 I
Casing Type:PVC, SCH. 80
Casing Diameter (in.):2.0
Screen Type:PVC, SCH. 80, 0.01 IN. SLOT
Screen Length (ft.):10.0
Total Casing and Screen (ft.):31.0
Casing Stick-up (ft.):2.00
Well Maintenance Date:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

SCREEN INTERVAL 29 FEET TO 19 FEET BELOW LAND SURFACE; FILTER PACK (MEDIUM QUARTZ SAND) FROM 30 FEET TO 10 FEET BELOW LAND SURFACE; BENTONITE GROUT FROM 10 FEET TO 3 FEET BELOW LAND SURFACE; CEMENT GROUT FROM 3 FEET BELOW LAND SURFACE TO LAND SURFACE; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1132.97 - 1130.97	0.0 - 2.0	TOPSOIL, BROWN, SILTY
1130.97 - 1122.97	2.0 - 10.0	CLAY, BLACK, SILTY
1122.97 - 1102.97	10.0 - 30.0	SAND AND GRAVEL, FINE SAND TO FINE GRAVEL

* * * *

Location Information

Legal Location:NW NW NW NE SEC. 02, T. 092 N., R. 50 W.
County:UNION
Location:092N-50W-02ABBB
Basin:BIG SIOUX
Latitude:42 49' 19"
Hydrologic Unit Code:10170203
Longitude: 96 43' 03"
Land Owner:
Ground Surface Elevation (ft.):1225 T

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:08/18/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-26
Total Drill Hole Depth (ft.):102.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 102 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1225.00 - 1223.00	0.0 - 2.0	TOPSOIL, BLACK, SILTY
1223.00 - 1199.00	2.0 - 26.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1199.00 - 1135.00	26.0 - 90.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1135.00 - 1123.00	90.0 - 102.0	SHALE, GRAY (CARLILE SHALE)

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Location Information

Legal Location:SE SE NW NE SEC. 02, T. 092 N., R. 50 W.
County:UNION
Location:092N-50W-02ABDD
Basin:BIG SIOUX
Latitude:42 49' 07"
Hydrologic Unit Code:10170203
Longitude: 96 42' 46"
Land Owner:
Ground Surface Elevation (ft.):1222 T

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:08/18/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-25
Total Drill Hole Depth (ft.):82.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 82 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1222.00 - 1214.00	0.0 - 8.0	TOPSOIL, BLACK, SILTY
1214.00 - 1209.00	8.0 - 13.0	CLAY, TAN, SILTY (TILL)
1209.00 - 1207.00	13.0 - 15.0	CHALK, WHITE (CHALK BLOCK)
1207.00 - 1204.00	15.0 - 18.0	CLAY, YELLOW, SILTY (TILL)
1204.00 - 1202.00	18.0 - 20.0	CLAY, GRAY (TILL)
1202.00 - 1195.00	20.0 - 27.0	CLAY, BROWN, SILTY (TILL)
1195.00 - 1170.00	27.0 - 52.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1170.00 - 1140.00	52.0 - 82.0	SHALE, DARK-GRAY (CARLILE SHALE)

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Location Information

Legal Location:NW NE SE NE SEC. 02, T. 092 N., R. 50 W.
County:UNION
Basin:BIG SIOUX
Hydrologic Unit Code:10170203
Land Owner:
Location:092N-50W-02ADAB
Latitude:42 49' 07"
Longitude: 96 42' 33"
Ground Surface Elevation (ft.):1222 T

Project Information

Project:STATEWIDE MONITORING
Drill Date:08/04/2008
Company:SDGS
Drilling Method:ROTARY
Test Hole Number:R2-2008-19
Samples:
Geologist:M. NOONAN
Geologist's Log:X
Driller:S. JENSEN
Driller's Log:
Total Drill Hole Depth (ft.):142.0

Geophysical Information

Spontaneous Potential:X
Natural Gamma:X
Single Point Resistivity:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 142 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1222.00 - 1220.00	0.0 - 2.0	TOPSOIL, BROWN
1220.00 - 1195.00	2.0 - 27.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1195.00 - 1185.00	27.0 - 37.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1185.00 - 1114.00	37.0 - 108.0	SHALE, DARK-GRAY (CARLILE SHALE)
1114.00 - 1090.00	108.0 - 132.0	LIMESTONE; INTERBEDDED LAYERS OF GRAY-BROWN CLAY (GREENHORN LIMESTONE)
1090.00 - 1080.00	132.0 - 142.0	SHALE, DARK-GRAY (GRANEROS SHALE)

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Location Information

Legal Location:SW SW NW NW SEC. 04, T. 092 N., R. 50 W.
County:UNION
Location:092N-50W-04BBCC 1
Basin:BIG SIOUX
Latitude:42 49' 03"
Hydrologic Unit Code:10170203
Longitude: 96 46' 01"
Land Owner:
Ground Surface Elevation (ft.):1236 T

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:07/30/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-17
Total Drill Hole Depth (ft.):245.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 245 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1236.00 - 1234.00	0.0 - 2.0	ROADFILL
1234.00 - 1226.00	2.0 - 10.0	CLAY, RED-BROWN, SILTY, SANDY, PEBBLY
1226.00 - 1205.00	10.0 - 31.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1205.00 - 1141.00	31.0 - 95.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1141.00 - 1131.00	95.0 - 105.0	GRAVEL, FINE; INTERBEDDED LAYERS OF FINE TO COARSE SAND
1131.00 - 1119.00	105.0 - 117.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1119.00 - 1056.00	117.0 - 180.0	SAND AND GRAVEL, FINE SAND TO FINE PEBBLE GRAVEL
1056.00 - 991.00	180.0 - 245.0	GRAVEL, FINE TO COARSE; INTERBEDDED LAYERS OF FINE TO COARSE SAND

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Location Information

Legal Location:NW NE NW NE SEC. 05, T. 092 N., R. 50 W.
County:UNION
Location:092N-50W-05ABAB
Basin:BIG SIOUX
Latitude:42 49' 20"
Hydrologic Unit Code:10170203
Longitude: 96 46' 23"
Land Owner:
Ground Surface Elevation (ft.):1234 T

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:07/22/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-15
Total Drill Hole Depth (ft.):245.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 245 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1234.00 - 1231.00	0.0 - 3.0	TOPSOIL, BLACK
1231.00 - 1212.00	3.0 - 22.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1212.00 - 1167.00	22.0 - 67.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1167.00 - 1157.00	67.0 - 77.0	CHALK, WHITE (CHALK BLOCK)
1157.00 - 1112.00	77.0 - 122.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1112.00 - 1031.00	122.0 - 203.0	SAND AND GRAVEL, FINE SAND TO FINE PEBBLE GRAVEL
1031.00 - 1027.00	203.0 - 207.0	GRAVEL, COARSE
1027.00 - 989.00	207.0 - 245.0	GRAVEL, FINE TO COARSE; INTERBEDDED LAYERS OF FINE TO COARSE SAND

* * * *

Location Information

Legal Location:SE SE SW SE SEC. 12, T. 092 N., R. 50 W.
County:UNION
Basin:BIG SIOUX
Hydrologic Unit Code:10170203
Land Owner:
Location:092N-50W-12DCDD
Latitude:42 47' 38"
Longitude: 96 41' 38"
Ground Surface Elevation (ft.):1199 T

Project Information

Project:STATEWIDE MONITORING
Drill Date:08/05/2008
Company:SDGS
Drilling Method:ROTARY
Test Hole Number:R2-2008-21
Samples:
Geologist:M. NOONAN
Geologist's Log:X
Driller:S. JENSEN
Driller's Log:
Total Drill Hole Depth (ft.):62.0

Geophysical Information

Spontaneous Potential:X
Natural Gamma:X
Single Point Resistivity:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 62 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1199.00 - 1197.00	0.0 - 2.0	TOPSOIL, BLACK
1197.00 - 1172.00	2.0 - 27.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1172.00 - 1151.00	27.0 - 48.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1151.00 - 1144.00	48.0 - 55.0	GRAVEL, FINE TO COARSE; INTERMITTENT LAYERS OF FINE TO COARSE SAND
1144.00 - 1137.00	55.0 - 62.0	SHALE, DARK-GRAY (CARLILE SHALE)

* * * *

Location Information

Legal Location:SW NW NW NW SEC. 14, T. 092 N., R. 50 W.
County:UNION
Location:092N-50W-14BBBC
Basin:BIG SIOUX
Latitude:46 47' 31"
Hydrologic Unit Code:10170203
Longitude: 96 43' 37"
Land Owner:
Ground Surface Elevation (ft.):1226.12 I

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:07/31/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-18
Total Drill Hole Depth (ft.):162.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 162 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1226.12 - 1224.12	0.0 - 2.0	TOPSOIL, BLACK
1224.12 - 1207.12	2.0 - 19.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1207.12 - 1129.12	19.0 - 97.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1129.12 - 1064.12	97.0 - 162.0	SAND AND GRAVEL, FINE SAND TO FINE PEBBLE GRAVEL

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Location Information

Legal Location:SW NW NW NW SEC. 14, T. 092 N., R. 50 W.
County:UNION
Location:092N-50W-14BBBC 1
Basin:BIG SIOUX
Latitude:42 47' 30"
Hydrologic Unit Code:10170203
Longitude: 96 43' 39"
Land Owner:
Ground Surface Elevation (ft.):1226.12 I

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:08/13/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-24
Total Drill Hole Depth (ft.):116.0
Samples:

Well Information

SDGS Well Name: R2-2008-24
Aquifer:LOWER-VERMILLION-MISSOURI
Water Rights Well:
Management Unit:
Other Well Name:
Casing Top Elevation:1228.12 I
Casing Type:PVC, SCH. 80
Casing Diameter (in.):2.0
Screen Type:PVC, SCH. 80, 0.01 IN. SLOT
Screen Length (ft.):10.0
Total Casing and Screen (ft.):116.3
Casing Stick-up (ft.):2.00
Well Maintenance Date:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

SCREEN INTERVAL FROM 114.3 FEET TO 104.3 FEET BELOW LAND SURFACE; FILTER PACK (MEDIUM QUARTZ SAND) FROM 114.3 FEET TO 98 FEET BELOW LAND SURFACE; BENTONITE GROUT FROM 98 FEET TO 4 FEET BELOW LAND SURFACE; CEMENT GROUT FROM 4 FEET BELOW LAND SURFACE TO LAND SURFACE; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1226.12 - 1224.12	0.0 - 2.0	ROADFILL
1224.12 - 1207.12	2.0 - 19.0	CLAY, TAN, SILTY, SANDY, PEBBLY (TILL)
1207.12 - 1128.12	19.0 - 98.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1128.12 - 1110.12	98.0 - 116.0	SAND AND GRAVEL, COARSE SAND TO MEDIUM GRAVEL

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Location Information

Legal Location:NE NE NE NE SEC. 24, T. 092 N., R. 50 W.
County:UNION
Basin:BIG SIOUX
Hydrologic Unit Code:10170203
Land Owner:
Location:092N-50W-24AAAA 1
Latitude:42 46' 45"
Longitude: 96 41' 18"
Ground Surface Elevation (ft.):1164.41 I

Project Information

Project:STATEWIDE MONITORING
Drill Date:08/11/2008
Company:SDGS
Drilling Method:ROTARY
Test Hole Number:R2-2008-22
Samples:
Geologist:M. NOONAN
Geologist's Log:X
Driller:S. JENSEN
Driller's Log:
Total Drill Hole Depth (ft.):60.0

Well Information

SDGS Well Name: R2-2008-22
Water Rights Well:
Other Well Name:
Casing Type:PVC, SCH. 80
Screen Type:PVC, SCH. 80, 0.01 IN. SLOT
Total Casing and Screen (ft.):51.9
Well Maintenance Date:
Aquifer:MISSOURI
Management Unit:ELK POINT
Casing Top Elevation:1166.41 I
Casing Diameter (in.):2.0
Screen Length (ft.):10.0
Casing Stick-up (ft.):2.00

Geophysical Information

Spontaneous Potential:
Natural Gamma:
Single Point Resistivity:
Extra:

SCREEN INTERVAL FROM 49.9 TO 39.9 FEET BELOW LAND SURFACE; FILTER PACK (MEDIUM QUARTZ SAND) FROM 49.9 TO 38 FEET BELOW LAND SURFACE; BENTONITE GROUT FROM 38 FEET TO 5 FEET BELOW LAND SURFACE; CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1164.41 - 1161.41	0.0 - 3.0	TOPSOIL, BLACK
1161.41 - 1145.41	3.0 - 19.0	CLAY, TAN, SILTY, SANDY, PEBBLY (TILL)
1145.41 - 1132.41	19.0 - 32.0	SAND AND GRAVEL, FINE SAND TO MEDIUM GRAVEL
1132.41 - 1108.41	32.0 - 56.0	GRAVEL, FINE TO COARSE; INTERBEDDED LAYERS OF FINE TO COARSE SAND
1108.41 - 1104.41	56.0 - 60.0	CLAY, BLACK, SILTY

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Location Information

Legal Location:NE SE NE SE SEC. 21, T. 093 N., R. 50 W.
County:UNION
Basin:BIG SIOUX
Hydrologic Unit Code:10170203
Land Owner:
Location:093N-50W-21DADA
Latitude:42 51' 25"
Longitude: 96 44' 39"
Ground Surface Elevation (ft.):1208.01 I

Project Information

Project:STATEWIDE MONITORING
Drill Date:08/04/2008
Company:SDGS
Drilling Method:ROTARY
Test Hole Number:R2-2008-20
Samples:
Geologist:M. NOONAN
Geologist's Log:X
Driller:S. JENSEN
Driller's Log:
Total Drill Hole Depth (ft.):82.0

Geophysical Information

Spontaneous Potential:X
Natural Gamma:X
Single Point Resistivity:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 82 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1208.01 - 1206.01	0.0 - 2.0	TOPSOIL, BLACK
1206.01 - 1198.01	2.0 - 10.0	CLAY, BLACK, VERY SILTY
1198.01 - 1188.01	10.0 - 20.0	SAND AND GRAVEL, FINE SAND TO COARSE GRAVEL
1188.01 - 1157.01	20.0 - 51.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1157.01 - 1139.01	51.0 - 69.0	SHALE, GRAY (CARLILE SHALE)
1139.01 - 1126.01	69.0 - 82.0	LIMESTONE; INTERBEDDED LAYERS OF GRAY-BROWN CLAY (GREENHORN LIMESTONE)

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Location Information

Legal Location:NE SE NE SE SEC. 21, T. 093 N., R. 50 W.
County:UNION
Location:093N-50W-21DADA 1
Basin:BIG SIOUX
Latitude:42 51' 25"
Hydrologic Unit Code:10170203
Longitude: 96 44' 49"
Land Owner:
Ground Surface Elevation (ft.):1208.01 I

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:09/02/2008
Geologist's Log:X
Company:SDGS
Driller:D. IVERSON
Drilling Method:AUGER
Driller's Log:
Test Hole Number:R20-2008-03
Total Drill Hole Depth (ft.):20.0
Samples:

Well Information

SDGS Well Name: R20-2008-03
Aquifer:ALLUVIUM
Water Rights Well:
Management Unit:
Other Well Name:
Casing Top Elevation:1210.51 I
Casing Type:PVC, SCH. 80
Casing Diameter (in.):2.0
Screen Type:PVC, SCH. 80, 0.01 IN. SLOT
Screen Length (ft.):10.0
Total Casing and Screen (ft.):22.0
Casing Stick-up (ft.):2.50
Well Maintenance Date:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

SCREEN INTERVAL 19.5 FEET TO 9.5 FEET BELOW LAND SURFACE; FILTER PACK (MEDIUM QUARTZ SAND) FROM 20 FEET TO 7 FEET BELOW LAND SURFACE; BENTONITE GROUT FROM 7 FEET TO 2.5 FEET BELOW LAND SURFACE; CEMENT GROUT FROM 2.5 FEET BELOW LAND SURFACE TO LAND SURFACE; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1208.01 - 1200.01	0.0 - 8.0	TOPSOIL, BLACK, SILTY
1200.01 - 1196.01	8.0 - 12.0	CLAY, GRAY, SILTY
1196.01 - 1188.01	12.0 - 20.0	SAND AND GRAVEL, FINE SAND TO MEDIUM GRAVEL

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Location Information

Legal Location:NE SE NE SE SEC. 29, T. 093 N., R. 50 W.
County:UNION
Location:093N-50W-29DADA
Basin:BIG SIOUX
Latitude:42 50' 34"
Hydrologic Unit Code:10170203
Longitude: 96 46' 00"
Land Owner:
Ground Surface Elevation (ft.):1248.33 I

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:07/29/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-16
Total Drill Hole Depth (ft.):262.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 262 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1248.33 - 1246.33	0.0 - 2.0	TOPSOIL, BLACK
1246.33 - 1226.33	2.0 - 22.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1226.33 - 1122.33	22.0 - 126.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1122.33 - 1078.33	126.0 - 170.0	SAND, FINE TO COARSE
1078.33 - 1033.33	170.0 - 215.0	SAND AND GRAVEL, FINE SAND TO FINE PEBBLE GRAVEL
1033.33 - 986.33	215.0 - 262.0	GRAVEL, FINE; INTERBEDDED LAYERS OF FINE TO COARSE SAND

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Location Information

Legal Location:NE SE NE SE SEC. 29, T. 093 N., R. 50 W.
County:UNION
Location:093N-50W-29DADA 1
Basin:BIG SIOUX
Latitude:42 50' 34"
Hydrologic Unit Code:10170203
Longitude: 96 46' 00"
Land Owner:
Ground Surface Elevation (ft.):1248.33 I

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:08/12/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-23
Total Drill Hole Depth (ft.):153.0
Samples:

Well Information

SDGS Well Name: R2-2008-23
Aquifer:LOWER-VERMILLION-MISSOURI
Water Rights Well:
Management Unit:
Other Well Name:
Casing Top Elevation:1250.33 I
Casing Type:PVC, SCH. 80
Casing Diameter (in.):2.0
Screen Type:PVC, SCH. 80, 0.01 IN. SLOT
Screen Length (ft.):10.0
Total Casing and Screen (ft.):141.5
Casing Stick-up (ft.):2.00
Well Maintenance Date:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

SCREEN INTERVAL FROM 139.5 FEET TO 129.5 FEET BELOW LAND SURFACE; FILTER PACK (MEDIUM QUARTZ SAND) FROM 139.5 TO 100 FEET BELOW LAND SURFACE; BENTONITE GROUT FROM 100 FEET TO 4 FEET BELOW LAND SURFACE; CEMENT GROUT FROM 4 FEET BELOW LAND SURFACE TO LAND SURFACE; LOCKING STEEL WELL PROTECTOR INSTALLED.

Elevation (ft.)	Depth (ft.)	Description
1248.33 - 1245.33	0.0 - 3.0	TOPSOIL, BLACK
1245.33 - 1222.33	3.0 - 26.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1222.33 - 1121.33	26.0 - 127.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1121.33 - 1095.33	127.0 - 153.0	SAND AND GRAVEL, COARSE SAND TO MEDIUM GRAVEL

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Location Information

Legal Location:SE SE SW NE SEC. 34, T. 093 N., R. 50 W.
County:UNION
Location:093N-50W-34ACDD
Basin:BIG SIOUX
Latitude:42 49' 46"
Hydrologic Unit Code:10170203
Longitude: 96 43' 56"
Land Owner:
Ground Surface Elevation (ft.):1227 T

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:08/19/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-27
Total Drill Hole Depth (ft.):102.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 102 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1227.00 - 1223.00	0.0 - 4.0	TOPSOIL, BLACK
1223.00 - 1210.00	4.0 - 17.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1210.00 - 1155.00	17.0 - 72.0	CLAY, GRAY, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1155.00 - 1140.00	72.0 - 87.0	SHALE, GRAY (CARLILE SHALE)
1140.00 - 1125.00	87.0 - 102.0	LIMESTONE, GRAY; INTERBEDDED LAYERS OF BROWN CLAY (GREENHORN LIMESTONE)

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Records of drilling used to construct the illustration titled
Cross section showing subsurface geology below
the proposed Hyperion Energy Center

Location Information

Legal Location:SE SE SE SE SEC. 36, T. 093 N., R. 51 W.

County:CLAY
Location:093N-51W-36DDDD
Basin:BIG SIOUX
Latitude:42 49' 22"
Hydrologic Unit Code:10170203
Longitude: 96 48' 23"
Land Owner:
Ground Surface Elevation (ft.):1235 T

Project Information

Project:LINCOLN-UNION CO. STUDY
Geologist:R. HAMMOND
Drill Date:10/31/1985
Geologist's Log:X
Company:SDGS
Driller:R. GRAVHOLT
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-85-128
Total Drill Hole Depth (ft.):255.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED FROM 255 TO 8 FEET WITH VOL PLUG (GREATER THAN 100 SECONDS MARSH FUNNEL VOLOCITY), 8 FEET TO 3 FEET WITH NEAT CEMENT, AND 3 TO 0 FEET WITH TOPSOIL. A PLASTIC PLUG WAS SET AT 8 FEET.

Elevation (ft.)	Depth (ft.)	Description
1235.00 - 1218.00	0.0 - 17.0	CLAY, LIGHT-BROWN, SILTY, SANDY, PEBBLY (TILL)
1218.00 - 1115.00	17.0 - 120.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1115.00 - 1104.00	120.0 - 131.0	SAND, DARK-GRAY, MEDIUM TO FINE, VERY SILTY
1104.00 - 1086.00	131.0 - 149.0	SAND, MEDIUM, WELL-SORTED, SUBROUNDED; LARGELY QUARTZ
1086.00 - 1059.00	149.0 - 176.0	GRAVEL, BROWN, MEDIUM TO FINE, SANDY
1059.00 - 1041.00	176.0 - 194.0	SAND, GREEN, MEDIUM TO COARSE, PEBBLY; SOME SHALE, COAL, AND CARBONATE CLASTS (WESTERN SANDS)
1041.00 - 1033.00	194.0 - 202.0	SILT, TAN TO LIGHT-GRAY, SANDY (LOESS)
1033.00 - 1013.00	202.0 - 222.0	CLAY, GRAY-BROWN, SANDY, SLIGHTLY PEBBLY (TILL)
1013.00 - 1004.00	222.0 - 231.0	GRAVEL, GREEN, MEDIUM, SANDY, SUBROUNDED TO SUBANGULAR, FAIR SORTING (WESTERN SANDS)
1004.00 - 980.00	231.0 - 255.0	SILTSTONE, LIGHT-GRAY-BROWN, VERY SANDY; CONTAINS THIN GRAY SHALE LAYERS (DAKOTA FORMATION)

Location Information

Legal Location:SW SW NW NW SEC. 04, T. 092 N., R. 50 W.
County:UNION
Location:092N-50W-04BBCC 1
Basin:BIG SIOUX
Latitude:42 49' 03"
Hydrologic Unit Code:10170203
Longitude: 96 46' 01"
Land Owner:
Ground Surface Elevation (ft.):1236 T

Project Information

Project:STATEWIDE MONITORING
Geologist:M. NOONAN
Drill Date:07/30/2008
Geologist's Log:X
Company:SDGS
Driller:S. JENSEN
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-2008-17
Total Drill Hole Depth (ft.):245.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 245 FEET TO 5 FEET BELOW LAND SURFACE, CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

Elevation (ft.)	Depth (ft.)	Description
1236.00 - 1234.00	0.0 - 2.0	ROADFILL
1234.00 - 1226.00	2.0 - 10.0	CLAY, RED-BROWN, SILTY, SANDY, PEBBLY
1226.00 - 1205.00	10.0 - 31.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1205.00 - 1141.00	31.0 - 95.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1141.00 - 1131.00	95.0 - 105.0	GRAVEL, FINE; INTERBEDDED LAYERS OF FINE TO COARSE SAND
1131.00 - 1119.00	105.0 - 117.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1119.00 - 1056.00	117.0 - 180.0	SAND AND GRAVEL, FINE SAND TO FINE PEBBLE GRAVEL
1056.00 - 991.00	180.0 - 245.0	GRAVEL, FINE TO COARSE; INTERBEDDED LAYERS OF FINE TO COARSE SAND

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Location Information

Legal Location:NW NE NE NE SEC. 04, T. 092 N., R. 50 W.
County:UNION
Basin:BIG SIOUX
Hydrologic Unit Code:10170203
Land Owner:
Location:092N-50W-04AAAB
Latitude:42 49' 21"
Longitude: 96 45' 05"
Ground Surface Elevation (ft.):1230 T

Project Information

Project:LINCOLN-UNION CO. STUDY
Drill Date:11/05/1984
Company:SDGS
Drilling Method:ROTARY
Test Hole Number:R1-84-103
Samples:
Geologist:R. HAMMOND
Geologist's Log:X
Driller:T. MCCUE
Driller's Log:
Total Drill Hole Depth (ft.):365.0

Geophysical Information

Spontaneous Potential:X
Natural Gamma:X
Single Point Resistivity:X
Extra:

Elevation (ft.)	Depth (ft.)	Description
1230.00 - 1227.00	0.0 - 3.0	TOPSOIL, BLACK
1227.00 - 1212.00	3.0 - 18.0	CLAY, YELLOW, VERY PEBBLY, SANDY (TILL)
1212.00 - 1192.00	18.0 - 38.0	CLAY, GRAY, VERY PEBBLY, SANDY (TILL)
1192.00 - 1161.00	38.0 - 69.0	GRAVEL, LIGHT-GRAY, VERY SANDY, CHALKEY, CLAYEY, ANGULAR
1161.00 - 1118.00	69.0 - 112.0	CLAY, LIGHT-GRAY, SILTY, PEBBLY (TILL)
1118.00 - 978.00	112.0 - 252.0	GRAVEL, FINE, VERY SANDY; MINOR SOFT ROCK FRACTION, SUBROUNDED
978.00 - 920.00	252.0 - 310.0	SANDSTONE, LIGHT-GRAY AND GRAY-BROWN, VERY SILTY; SOME THIN GRAY TO BLACK SHALE BEDS (DAKOTA FORMATION)
920.00 - 865.00	310.0 - 365.0	SANDSTONE, WHITE TO LIGHT-GRAY, FINE TO VERY FINE; ABUNDANT LIGHT-TAN AND LIGHT-GRAY SHALE LENSES AT 325 TO 359 FEET (DAKOTA FORMATION)

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Location Information

Legal Location:SE SW SW SW SEC. 36, T. 093 N., R. 50 W.
County:UNION
Location:093N-50W-36CCCD
Basin:BIG SIOUX
Latitude:42 49' 23"
Hydrologic Unit Code:10170203
Longitude: 96 42' 27"
Land Owner:
Ground Surface Elevation (ft.):1180 T

Project Information

Project:LINCOLN-UNION CO. STUDY
Geologist:M. JARRETT
Drill Date:07/02/1986
Geologist's Log:X
Company:SDGS
Driller:J. FRAZIER
Drilling Method:AUGER
Driller's Log:
Test Hole Number:A2-86-176
Total Drill Hole Depth (ft.):28.0
Samples:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

Elevation (ft.)	Depth (ft.)	Description
1180.00 - 1178.00	0.0 - 2.0	TOPSOIL
1178.00 - 1161.00	2.0 - 19.0	CLAY, BROWN, SILTY, SANDY; OXIDIZED (TILL)
1161.00 - 1156.00	19.0 - 24.0	CLAY, TAN, SILTY, SANDY; OXIDIZED (TILL)
1156.00 - 1152.00	24.0 - 28.0	CLAY, GRAY, SILTY, SANDY; UNOXIDIZED (TILL)

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Location Information

Legal Location:NW NW NW NW SEC. 06, T. 092 N., R. 49 W.

County:UNION
Location:092N-49W-06BBBB
Basin:BIG SIOUX
Latitude:42 49' 19"
Hydrologic Unit Code:10170203
Longitude: 96 41' 14"
Land Owner:
Ground Surface Elevation (ft.):1290 T

Project Information

Project:LINCOLN-UNION CO. STUDY
Geologist:R. HAMMOND
Drill Date:11/05/1985
Geologist's Log:X
Company:SDGS
Driller:C. SCHMIG
Drilling Method:ROTARY
Driller's Log:
Test Hole Number:R2-85-134
Total Drill Hole Depth (ft.):180.0
Samples:

Geophysical Information

Spontaneous Potential:X
Single Point Resistivity:X
Natural Gamma:X
Extra:

THIS HOLE WAS PLUGGED BY PRESSURE GROUTING FROM BOTTOM TO 8 FEET WITH BENTONITE SLURRY (GREATER THAN 100 SECOND MARSH FUNNEL VISCOSITY), A PLUG WAS SET AT 8 FEET, NEAT CEMENT POURED FROM 8 FEET TO 3 FEET AND BACKFILLED TO SURFACE WITH TOPSOIL.

Elevation (ft.)	Depth (ft.)	Description
1290.00 - 1268.00	0.0 - 22.0	CLAY, YELLOW, VERY SILTY; NUMEROUS RED- BROWN ROOT CASTS (LOESS)
1268.00 - 1234.00	22.0 - 56.0	SILT, REDDISH-BROWN, MOTTLED WITH GRAY FROM 35 TO 56 FEET, SANDY, CLAYEY (LOESS)
1234.00 - 1217.00	56.0 - 73.0	CLAY, ORANGE TO DARK-GRAY; GREASY, SOFT (CARLILE SHALE)
1217.00 - 1180.00	73.0 - 110.0	CLAY, DARK-GRAY-BROWN; FAIR SHALEY PART- ING, HARD, SLIGHTLY CALCAREOUS, WHITE BENTONITE AT 81 TO 82 FEET, HIGH GAMMA VALUES AT 73 TO 98 FEET (FAIRPORT SHALE MEMBER - CARLILE SHALE)
1180.00 - 1171.00	110.0 - 119.0	SILTSTONE, DARK-GRAY-BROWN, CLAYEY; SOFT, CALCAREOUS, FAIR SHALEY PARTINGS (FAIR- PORT SHALE MEMBER - CARLILE SHALE)
1171.00 - 1120.00	119.0 - 170.0	CLAYSTONE, DARK-GRAY, SLIGHTLY SILTY; SLIGHTLY CALCAREOUS, FAIR TO GOOD SHALEY PARTINGS (FAIRPORT SHALE MEMBER - CARLILE SHALE)
1120.00 - 1110.00	170.0 - 180.0	SILTSTONE, GRAY-BROWN; VERY CALCAREOUS, MANY LAYERS CONSIST OF PRIMARILY INO- CERAMUS SHELL DEBRIS; ROUGH IRREGULAR DRILLING CHARACTER (GREENHORN LIMESTONE)

Location Information

Legal Location:NW NE NE NW SEC. 04, T. 092 N., R. 49 W.
County:UNION
Location:092N-49W-04BAAB
Basin:BIG SIOUX
Latitude:42 49' 20"
Hydrologic Unit Code:10170203
Longitude: 96 38' 17"
Land Owner:
Ground Surface Elevation (ft.):1205 T

Project Information

Project:LINCOLN-UNION CO. STUDY
Geologist:M. JARRETT
Drill Date:07/08/1986
Geologist's Log:X
Company:SDGS
Driller:K. WUNDER
Drilling Method:AUGER
Driller's Log:
Test Hole Number:A1-86-141
Total Drill Hole Depth (ft.):28.0
Samples:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

Elevation (ft.)	Depth (ft.)	Description
1205.00 - 1189.00	0.0 - 16.0	CLAY, BLACK, SILTY; OXIDIZED, MOIST
1189.00 - 1184.00	16.0 - 21.0	CLAY, BLACKISH-BROWN, SILTY, SLIGHTLY SANDY; OXIDIZED, SATURATED
1184.00 - 1177.00	21.0 - 28.0	CLAY, BLACKISH-BROWN, SILTY, SLIGHTLY SANDY; OXIDIZED, SATURATED

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Location Information

Legal Location:SW SW NW NW SEC. 03, T. 092 N., R. 49 W.
County:UNION
Basin:BIG SIOUX
Hydrologic Unit Code:10170203
Land Owner:
Location:092N-49W-03BBCC
Latitude:42 49' 08"
Longitude: 96 37' 31"
Ground Surface Elevation (ft.):1285 T

Project Information

Project:LINCOLN-UNION CO. STUDY
Drill Date:11/05/1985
Company:SDGS
Drilling Method:ROTARY
Test Hole Number:R2-85-133
Samples:
Geologist:R. HAMMOND
Geologist's Log:X
Driller:R. GRAVHOLT
Driller's Log:
Total Drill Hole Depth (ft.):280.0

Well Information

SDGS Well Name: R2-85-133
Water Rights Well:
Other Well Name:
Casing Type:PVC
Screen Type:PVC, MFG.
Total Casing and Screen (ft.):270.0
Well Maintenance Date:
Aquifer:DAKOTA
Management Unit:
Casing Top Elevation:1288.00 T
Casing Diameter (in.):2.0
Screen Length (ft.):10.0
Casing Stick-up (ft.):

Geophysical Information

Spontaneous Potential:X
Natural Gamma:X
Single Point Resistivity:X
Extra:

THIS WELL WAS GRAVEL PACKED FROM 280 TO 200 FEET, PRESSURE GROUTED FROM 200 TO 20 FEET WITH BENTONITE SLURRY (GREATER THAN 100 SECONDS MARSH VOLOCITY), THEN FILLED WITH NEAT CEMENT GROUT FROM 20 FEET TO GROUND LEVEL.

Elevation (ft.)	Depth (ft.)	Description
1285.00 - 1251.00	0.0 - 34.0	CLAY, YELLOW, VERY SILTY, SANDY (LOESS)
1251.00 - 1198.00	34.0 - 87.0	SILT, REDDISH-BROWN, SANDY, CLAYEY, VERY SANDY AT 45 TO 87 FEET (LOESS)
1198.00 - 1139.00	87.0 - 146.0	CLAY, DARK-GRAY-BROWN; FAIR TO POORLY FISSILE, HARD, SLIGHTLY CALCAREOUS (FAIRPORT SHALE MEMBER - CARLILE SHALE)
1139.00 - 1111.00	146.0 - 174.0	SILTSTONE, DARK-GRAY-BROWN; VERY CALCAREOUS; CONTAINS ABUNDANT SHELL DEBRIS (GREENHORN LIMESTONE)
1111.00 - 1065.00	174.0 - 220.0	CLAY, GRAY-BROWN; HARD, SLIGHTLY CALCAR- EOUS (GRANEROS SHALE)

1065.00 - 1025.00	220.0 - 260.0	SILTSTONE, GRAY; WITH THIN SHALE AND SANDSTONE LENSES (DAKOTA FORMATION)
1025.00 - 1015.00	260.0 - 270.0	SANDSTONE, LIGHT-GRAY, VERY FINE; POORLY CEMENTED (DAKOTA FORMATION)
1015.00 - 1006.00	270.0 - 279.0	SANDSTONE(?), GRAY, VERY SHALEY (DAKOTA FORMATION)

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Location Information

Legal Location:NE NW NW NW SEC. 02, T. 092 N., R. 49 W.
County:UNION
Location:092N-49W-02BBBA
Basin:BIG SIOUX
Latitude:42 49' 20"
Hydrologic Unit Code:10170203
Longitude: 96 36' 17"
Land Owner:
Ground Surface Elevation (ft.):1128 T

Project Information

Project:BIG SIOUX HYDRO STUDY
Geologist:W. BRADFORD
Drill Date:06/19/1985
Geologist's Log:
Company:SDGS
Driller:D. IVERSON
Drilling Method:HOLLOWSTEM
Driller's Log:X
Test Hole Number:R20-85-104
Total Drill Hole Depth (ft.):25.0
Samples:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

Elevation (ft.)	Depth (ft.)	Description
1128.00 - 1126.00	0.0 - 2.0	TOPSOIL, BLACK
1126.00 - 1106.00	2.0 - 22.0	CLAY, YELLOWISH-BROWN
1106.00 - 1103.00	22.0 - 25.0	CLAY, GRAY

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Location Information

Legal Location:NW NW NE NE SEC. 02, T. 092 N., R. 49 W.
County:UNION
Location:092N-49W-02AABB
Basin:BIG SIOUX
Latitude:42 49' 20"
Hydrologic Unit Code:10170203
Longitude: 96 35' 28"
Land Owner:
Ground Surface Elevation (ft.):1131 T

Project Information

Project:LINCOLN-UNION CO. STUDY
Geologist:M. JARRETT
Drill Date:07/01/1986
Geologist's Log:X
Company:SDGS
Driller:J. FRAZIER
Drilling Method:AUGER
Driller's Log:
Test Hole Number:A2-86-164
Total Drill Hole Depth (ft.):28.0
Samples:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

Elevation (ft.)	Depth (ft.)	Description
1131.00 - 1124.00	0.0 - 7.0	ROADFILL
1124.00 - 1110.00	7.0 - 21.0	CLAY, BROWN, SILTY, SANDY, PEBBLY; OXIDIZED (TILL)
1110.00 - 1105.00	21.0 - 26.0	CLAY, BROWN, VERY SILTY, SANDY; OXIDIZED (TILL)
1105.00 - 1098.00	26.0 - 33.0	CLAY, BROWN, SILTY, VERY SANDY, PEBBLY; OXIDIZED (TILL)

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Location Information

Legal Location:SE NW SW SE SEC. 36, T. 093 N., R. 49 W.
County:PLYMOUTH, IA
Location:093N-49W-36DCBD
Basin:BIG SIOUX
Latitude:42 49' 30"
Hydrologic Unit Code:10170203
Longitude: 96 34' 29"
Land Owner:
Ground Surface Elevation (ft.):1135 T

Project Information

Project:BIG SIOUX HYDRO STUDY
Geologist:W. BRADFORD
Drill Date:06/10/1985
Geologist's Log:
Company:SDGS
Driller:D. IVERSON
Drilling Method:HOLLOWSTEM
Driller's Log:X
Test Hole Number:R20-85-57
Total Drill Hole Depth (ft.):30.0
Samples:

Geophysical Information

Spontaneous Potential:
Single Point Resistivity:
Natural Gamma:
Extra:

Elevation (ft.)	Depth (ft.)	Description
1135.00 - 1133.00	0.0 - 2.0	TOPSOIL, BLACK
1133.00 - 1120.00	2.0 - 15.0	CLAY, YELLOWISH-BROWN (TILL)
1120.00 - 1115.00	15.0 - 20.0	SAND, MEDIUM
1115.00 - 1105.00	20.0 - 30.0	CLAY, GRAY

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